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EAS

ENGINEERING AND APPLIED SCIENCE

ORIGINAL
COMPLETED

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Phase I Awards — July, 1980

September 1980

Directorate for Engineering and Applied Science
National Science Foundation
Washington, DC

NSF/RA-800179

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SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Phase I Awards — July, 1980

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Table of Contents

Introduction.......... vii
NSF News Release Announcing Awards ix

Topic 1 - Advanced Measurement Research

Electron Beam Lethography of Protein Monolayer, Ultrathin Composite Resist Films
EMV Associates, Inc., Rockville, MD.......... 1
NMR Imaging Microscope
Intermagnetics General Corp., Guilderland, NY 1
Acoustic Concept for Measuring Particle Size Distributions
KLD Associates, Inc., Huntington Station, NY 2
Acoustooptic Filter Side Lobe Supression
Lansing Research Corporation, Ithaca, NY.......... 3
Superconducting Magnetometer with Quantum Noise Limited Sensitivity
and Enhanced Coupling Properties
LuTech, Inc., Berkeley, CA 3
Detection and Identification of Fish Schools From Sonar Echoes
ORINCON Corp., La Jolla, CA.......... 4
Near Surface Flaw Detection by Ultrasonic Critical Angle Imaging
Spectron Development Laboratories, Inc., Costa Mesa, CA 5

Topic 2 - Advanced Production Research for Discrete Parts Manufacturing

Numerical-Controlled Orbital Forging Processes
Dyna East Corp., Wynnewood, PA 6
Adaptive Arc Tracking For Welding
The Merrick Corp., Nashville, TN 6
Adaptive Welding System
Taylor Systems Engineering, Inc., Fair Oaks, CA.......... 6

Topic 3 - Industrial Processes

Toughened Ceramic Adhesives for Structural Ceramics
Ceramic Finishing Co., State College, PA.......... 8
Electrorefining of Aluminum
Castle Technology Corporation, Lexington, MA 8
Electrorefining of Sodium Using Solid State Rapid Ion Conductors
Ceramatec, Inc., Salt Lake City, UT 9
By-Product Molybdenum Recovery
Hazen Research, Inc., Tucson, AZ.......... 9
Thin Steel Sheet Made From Melt Extracted Flake
Ribbon Technology Corporation, Canal Winchester, OH.......... 10
Suspended Solids Removal Using Cross-Flow, In-Depth Filtration
T.S. Associates, Inc., Columbia, MD 10

Topic 4 - Deep Mineral Resources

A Multi-Channel Ultra-Sensitive Analyzer for Mineral Resources
General Ionex Corporation, Newburyport, MA 12
Interpolation of N-dimensional Geophysical Data
Zycor, Inc., Austin, TX 12

Topic 5 - Alternative Biological Sources of Materials

Microalgae Production of Glycerol and Related Chemicals on Saline Waters
  Ecoenergetics, Inc., Vacaville, CA 13
Investigation of New Source of Natural Rubber in the United States
  Native Plants, Inc., Salt Lake City, UT 13
The Chinese Tallow Tree as a Source of Petroleum Substitutes
  Simco, Inc., Weston, CT 14

Topic 6 - Microbial Fertilizers, Activators, and Conditioners

A Mycorrhizal Inoculated Containerized Plant Growing System
  Native Plants, Inc., Salt Lake City, UT 15

Topic 7 - Human Nutrition

The Measurement of Dielectric Constant as a Method for
Quality Assessment of Frying Oils
  Northern Instruments Corp., Lino Lakes, MN 16

Topic 8 - Advanced Marine Farming

Enrichment of a Brackish Water Pond for Shellfish
  Ocean Pond Corporation, Fishers Island, NY 17
Off-shore Abalone Farm Research Project
  Pacific Ocean Farms, Ltd., Carmel Valley, CA 17
Commercial Potential of Sex Reversal on Hybrid Tilapia
  Terry M. and Sari K. Astro, Eleele, Kauai, HI 18

Topic 9 - Groundwater Pollution

Waste Pond Treatment with Immobilized Liquid Ion Exchangers
  Bend Research, Inc., Bend, OR 19
In-Situ Gelation to Control Emissions from Abandoned Hazardous Waste Sites
  Energy and Environmental Engineering, Inc. Cambridge, MA 19
Halocarbon Emulsions as Safe & Effective Hydrological Tracers
  Energy Resources Co., Inc., La Jolla, CA 20

Topic 10 - Earthquake Engineering, Architecture and Urban Planning

Morphology of Tensile and Pneumatic Structural Systems for Seismic Design
  ABRI Inc., Cambridge, MA 21
Application of Randomdec Technique to Improve the Earthquake
Survivability of Structures on Soil Foundation
  Advanced Technology & Research, Inc., Silver Spring, MD 21
Investigation of the Seismic Resistance of Interior Building Partitions
  Agbabian Assoc., El Segundo, CA 22
Mitigation of Seismic Hazards in Tilt-up-Wall Structures
  Agbabian Assoc., El Segundo, CA 22
Establishing a National Testing Capability for the Simulation of
Earthquake Loads on Large-Scale Structures
  Higgins, Auld & Associates, Inc., Albuquerque, NM 23
Earthquake Hazard Mitigation By Friction Cells Damping
  Iffland Kavanagh Waterbury, New York, NY 23
Earthquake Damage Evaluation
  Ruthroff, Englekirk and Hart, Inc., Los Angeles, CA 24

Methodology for Evaluating and Improving Operational and Non-Structural Aspects of Office Buildings
Space for People, Los Angeles, CA 25
Response Surface Method in Geotechnical/Structural Analysis
Weidlinger Associates, Menlo Park, CA 25

Topic 11 - Science and Technology to Aid the Handicapped

Electrodes to Aid the Handicapped
Annex Research, Santa Ana, CA 27
The Effect of Chemical Modification of Bone Cements on Their Young's Moduli
Polysciences, Inc., Warrington, PA 27
Microprocessor-Based Integration of Artificial Reflexes & Sensory Feedback for Prosthetic Control
Scientific Systems, Inc., Cambridge, MA 28
Voice Response Aids for the Handicapped
Signal Technology, Inc., Santa Barbara, CA 28
Enhancement of Speech Intelligibility for the Hearing Impaired
Signatron, Inc., Lexington, MA 29

Topic 12 - Appropriate Technology

Cost Reduction in Irrigation Well Pump Application
Aerospace Research Corporation, Roanoke, VA 30
Testing and Evaluation of Equipment Used in Recycling Centers
Cal Recovery Systems, Inc., Richmond, CA 30
Correlation Between Early Linear Measurements and Future Performance and Carcass Characteristics in Cattle
Control Dynamics Company, Huntsville, AL 31
Small Scale Reclamation/Disposal of Toxic Porcelain Enameling Wastewater Sludges
Donohue & Assoc., Inc., Sheboygan, WI 31
Small Purification Systems
Electro-Chlor Corporation, Worthington, OH 31
Biodegradable Solid Waste Conversion Into Earthworm Castings
Flowerfield Enterprises, Kalamazoo, MI 32
Managing a Small Scale Solid Waste Resources Recovery Facility
Floyd Browne Assoc., Ltd., Marion, OH 32
Development of Mineral Wool from Industrial Wastes
Glass & Ceramics International, Inc., Lomita, CA 33
Permanent Cropping System for Small-Scale Farms
International Science & Technology Institute, Inc., Washington, DC 33
Elimination of Septic Tank Sludge Transport via Truck
George D. Ward & Associates, Portland, OR 34
An Inexpensive Biologic Method of Upgrading Lagoon Effluent
Dufresne-Henry, Inc., North Springfield, VT 34

Topic 13 - Applied Research Project Support

An Anthropometric Data Base for Commercial Design Applications
Anthropology Research Project, Inc., Yellow Springs, OH 35
Supply-Oriented Regional Macroeconometric Forecasting Model
Applied Forecasting & Analysis, Inc., Palo Alto, CA 35
Improvement of the Transverse Strength of Graphite/Aluminum Composites by Hybridization with SiC Whiskers
Artech Corp., Falls Church, VA 36
Investigation of the Super Plastic Drawing of Acrylic Fibers
Fiber Materials, Inc., Biddeford, ME 36

Hydrostatic Extrusion of In-Situ Process Superconductive Wire for Use in NMR Magnets
Intermagnetics General Corp., Guilderland, NY 37
Alternative Silver Zeolite Concepts
Ionex Research Corporation, Broomfield, CO 37
Advanced Underwater Telemetry and Voice Links for Inland and Coastal Waters Research
Osborne-Hoffman, Inc., Point Pleasant Beach, NJ 38
Theoretical Modeling of an Innovative Unidirectional Surface Acoustic Wave Transducer
R.F. Monolithics, Inc., Dallas, TX 38

Alphabetical List of Awardees........ 39
State Listing of Awardees........ 43

NSF SMALL BUSINESS INNOVATION RESEARCH PROGRAM

In 1977 the National Science Foundation (NSF) initiated a "Small Business Innovation Research" program which solicited research proposals from profit-seeking small firms with 500 or fewer employees in all affiliated organizations. A second solicitation was held in 1979 and a third in 1980 with the number of proposals increasing from 329 in 1977, to 408 in 1979, and to 530 in 1980. The number of awards has increased also from 42 in 1977, to 54 in 1979, and to 62 in 1980. One-half of the Phase I awards were funded for Phase II in the 1977 solicitation. Phase II awards under the 1979 solicitations are still under consideration.*

The program is a three-phase approach to funding research on NSF objectives and then converting that research into technological innovation and commercial applications. Phase I represents small awards of up to $25,000 for six months to determine as much as possible within these constraints whether the research idea appears technically feasible and whether the firm can do quality research. Those projects most promising in Phase I are funded for Phase II, which is the principal research project. Phase II awards have averaged $200,000 for one-two years of effort. Both Phases I and II are funded by NSF on NSF objectives but also serve as preventure capital for high-risk, research-based ideas.

Phase III is the product or process development phase for the small firm to pursue commercial objectives from the same research base with private venture capital. Phase III funds must be obtained from a third party such as a venture capital firm or a manufacturer already in the same field. The use of the third party provides an objectivity to the program and a coupling to market needs, management evaluation and follow-up funding. All are necessary if the research is to be successful in moving from meeting Federal needs to commercial applications. The approach also initiates technology transfer at the research planning stage rather than after the Federal R&D has been completed or a product delivered. To date more than $7 million of private funding from large industrial and venture capital firms has been obtained by the small firms as well as many additional commitments. In addition, the average employment for all firms receiving Phase II awards in the 1977 solicitation has more than doubled since they submitted their Phase I proposals three years ago.

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* Information on grants awarded in 1977 and 1979 respectively appear in: NSF/RA-790160, EAS Small Business Awards; Completed Projects from Phase I of the First NSF/EAS Small Business Solicitations and NSF/RA-800050, EAS Small Business Innovation Research Program Phase I Awards - September 1979. These publications are available at no cost from: EAS Information Resources, National Science Foundation, Washington, DC 20550.

Research projects described in this brochure represent the 62 Phase I awards made under the 1980 program solicitation. The following project summaries were prepared by the assigned NSF Program Managers. Currently these projects are conducting the Phase I effort which will be completed by February 28, 1981.

Roland Tibbetts
Program Manager for Innovation and Small Business
Engineering and Applied Science Directorate
National Science Foundation

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NATIONAL SCIENCE FOUNDATION
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62 SMALL BUSINESS FIRMS
RECEIVE INNOVATION RESEARCH AWARDS

The National Science Foundation (NSF) has made 62 awards totaling $1.5 million to small science-and technology-based business firms. The awards made through the Foundation's Small Business Innovation Research (SBIR) Program reflect the NSF's interest in such firms and the important role they play in converting research into technological innovation and commercial applications.

The program serves as a source of early funding of innovative high-risk research of interest to the Foundation by creative small science-or technology-based firms. Research was funded in the following areas: advanced measurement research; advanced production research for discrete parts manufacturing; industrial processes; deep mineral resources; alternative biological sources of materials; microbial fertilizers, activators, and conditioners; human nutrition; advanced marine farming; groundwater pollution; earthquake engineering, architecture, and urban planning; science and technology to aid the handicapped; appropriate technology; applied research project support.

-more-

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The awards are for phase I of a three-phase program. Phase I awards are for up to $25,000 and six months to determine as much as possible, within these limitations, about whether the idea appears technically feasible and about the ability of the firm to do high-quality research.

Phase II is the principal research effort for those projects appearing the most promising after the first phase. These awards have averaged $200,000 for 1-2 years. Phase III involves follow-on private funding from venture capital or larger industrial firms to pursue commercial applications from the government funded research.

The primary objective of the program is to fund small business firms for high-risk research that can have significant public benefit if the research is successful.

A second goal is the conversion of the Government research into technological innovation and commercial applications, to increase its economic and social benefits to the Nation. This is accomplished by encouraging the small business firm to obtain an advance commitment for the phase III funding from a third party prior to government investment in phase II. The actual investment may be contingent upon the phase II research meeting certain technical objectives. Through the SBIR program, government research is coupled to market needs and possible new technology-based products, processes, or services. This also stimulates technology transfer considerations of the government research to the private sector at the beginning of the research planning process, rather than after government R&D has been done or a product produced.

Some 530 proposals received were from 42 states and the District of Columbia. Firms receiving awards ranged from a new start-up one-man organization to a company with 489 employees. Sixty-three percent of the firms had 25 or less employees.

-END-

A complete listing of companies receiving awards is attached.

TOPIC 1

ADVANCED MEASUREMENT RESEARCH

1. Electron Beam Lithography of Protein Monolayer, Ultrathin Composite Resist Films

EMV Associates, Inc., Rockville, MD

NSF Grant No. DAR80-09745 Amount: $24,305

Packing density and speed of computing elements are directly related to the resolution achievable by a given lithographic approach. Ultimate computational capability of new, low heat dissipating or noise processes, such as CCD's, bubble memories or Josephson junctions, are limited in part to 2500A resolution provided by state-of-the-art electron beam or x-ray lithography. To produce lines substantially below this limit, novel approaches to resist materials and lithography are needed. This research is aimed at demonstrating that high resolution (100A) masks can be achieved using ultrathin composite resist films. These films are formed by enveloping a protein monolayer with a resist on a support film and exposing the film with an electron beam so as to: (1) minimize electron scatter effects; and (2) allow chemical linking of active enzymes to the protein. These enzymes catalyze reactions that deposit x-ray or electron dense materials such as Pb, Ag, Ru and Te. Protein affinity and enzyme-catalyzed reactions permit the specific deposition of many chemical elements, either individually or in combination. The implications of this approach include novel deposition capabilities, high resolution, and potentially higher writing speeds. More significant, however, is the possibility of developing these protein macromolecules and other polymeric materials into functional elements of ultramicrodevices.

* * * * * * *

2. NMR Imaging Microscope

Intermagnetics General Corporation, Guilderland, NY

NSF Grant No. DAR80-09739 Amount: $23,900

If resolution of nuclear magnetic resonance (NMR) imaging of biological systems is improved, it can provide a capability for NMR microscopy. It will then become possible to examine individual cells and to explore on a cell-by-cell basis the functional differences between normal and abnormal cells for both research and diagnostics. It is anticipated that resolution can be substantially improved by applying NMR techniques to very small objects under magnetic field and frequency conditions not achievable for large objects. This study measures and quantifies the influences of both probe geometry for the very small dimensions required and magnetic field strengths at the very high values necessary for maximum resolution; it also explores the possibility of sharpening the resonance frequencies and improving resolution by stimulating the nuclei with appropriate time-dependent ratio-frequency pulses.

* * * * * * *

3. Acoustic Concept for Measuring Particle Size Distributions

KLD Associates, Inc., Huntington Station, NY

NSF Grant No. DAR80-09595 Amount: $25,000

An important problem in air pollution control is the measurement of particulate emissions from power plants and other industrial processes. The small particles are recognized as most harmful since they readily enter the respiratory system and subject humans to toxic materials. Techniques to accurately monitor the size and distribution of these small particles (1 μm and less) is a continuing requirement. This research is for the feasibility study and evaluation of an acoustic method of measuring the size and concentration of small particles entrained in air. The technique, which has been investigated analytically, is based upon the changes in the speed of sound as caused by the presence of particles. The major objective of this research project is the experimental evaluation and verification of these concepts. Specifically, the results will be obtained with respect to (1) the measurement and resolution of mean particle size; (2) the measurement of total mass loading in the gas; and (3) the variance of the particle distribution about its mean.

* * * * * * *

4. Acoustooptic Filter Side Lobe Suppression

Lansing Research Corporation, Ithaca, NY

NSF Grant No. DAR80-09850 Amount: $24,829

A non-destructive, optical imaging microprobe operating in real time is of significant value for the study of materials including *in vitro* biological samples, semiconductors and VLSI structures. A tunable acoustooptic filter (TAOF) offers desirable operating characteristics as the key bandpass determining element in an instrument utilizing the Raman effect to identify molecular constituents. These characteristics include high optical throughput, random spectral access, polarization selectivity and optical clarity. The existence of side lobes on the TAOF optical transfer function is a problem in spectroscopy. The research undertakes appropriate mathematical analysis of the operation of a TAOF to yield an understanding of how to suppress the data originating in side lobes. The objective is to obtain a mathematical formulation based upon both the theoretical side lobe characteristics and the measured characteristics of a real TAOF. This mathematical formulation is then incorporated in the operating program of a computer controlled TAOF experiment to test its effectiveness with monochromatic light sources. These results permit an assessment of how effectively the TAOF performs off-resonance rejection at varied spectral locations relative to the resonant main lobe.

* * * * * * *

5. Superconducting Magnetometer with Quantum Noise Limited Sensitivity and Enhanced Coupling Properties

LuTech, Inc., Berkeley, CA

NSF Grant No. DAR80-09388 Amount: $24,472

Superconducting magnetometers (SQUIDs) are presently being used to make highly sensitive measurements of changes in magnetic flux. These devices find widespread application as magnetometers, gradiometers, susceptometers and linear current amplifiers in such diverse fields as geophysical exploration, materials analysis, magnetoencephalography, gravity wave detection and numerous others. The study will analyze and test the feasibility of a novel superconducting magnetometer. The sensitivity of this device is expected to be 3-4 orders of magnitude more sensitive than the present generation of commercially available devices. In addition, the coupling properties of the device will be substantially enhanced. This is expected to significantly increase the range of application of magnetometers and linear amplifiers based on this device. The design consists of a two-loop thin film structure incorporating two Josephson tunnel junctions. One loop will serve as a coupling loop with variable inductance chosen to optimally match the magnetometer to the source. The other double junction loop inductance will be reduced several orders of magnitude below the conventional dc SQUID loop inductance. As a result, these devices can be fabricated with conventional aperature mask technology. This permits the development of quantum noise limited devices with enhanced coupling properties by small, applications-oriented businesses.

* * * * * * *

6. Detection and Identification of Fish Schools from Sonar Echoes

ORINCON Corporation, La Jolla, CA

NSF Grant No. DAR80-09588 Amount: $24,639

Efficiency of tuna and other commercial fishing ventures depends upon the fishermen's capability to detect and classify schools of fish at long range. Long-range sonar detection is degraded by downward bending of transmitted sound, and the presence of noise and clutter. A general solution of the problem involves towed upward-looking sonar transducers at depths on the order of several hundred meters, and a signal design/echo representation that contains sufficient information to allow recognition of a fish school and rejection of surface reflections. This research, a theoretical approach to this measurement problem, incorporates pattern recognition techniques as applied to spectrograms of broadband echoes, and optimum sonar placement strategies using ray-tracing arguments. The approach can be applied to existing echo data and to new data via computer processing of recorded echoes. The objective of the research is to improve the detection and identification of fish schools using sonar echoes.

* * * * * * *

7. Near Surface Flaw Detection by Ultrasonic Critical Angle Imaging

Spectron Development Laboratories, Inc., Costa Mesa, CA

NSF Grant No. DAR80-09279 Amount: $24,723

Modern ceramic and super alloy materials are designed for critical components where high temperatures and stresses occur. It is important that these materials be defect free so that their full potential can be utilized. This is particularly important near the surface of the component since this is where cracks are most likely to form. Conventional ultrasonic inspection techniques are least sensitive near the surface because of transducer ringdown and multiple reflections. There is an interesting property of ultrasound which promises to provide a sensitive indicator of near surface condition, namely, the Rayleigh critical angle. The behavior of the reflected sound at the critical angle is influenced by material parameters such as grain size, hardness, surface residual stress, and material variation. The objective of this research is to establish the feasibility of using some or all of the measurable quantities of amplitude and phase of the reflected wave, frequency of least reflection, and the critical angle itself to form images of near surface defects. By using a combination of these measures, it may be possible to separately determine grain size, surface stress, and material defects in the near surface region of the material. Successful completion of this research could lead to improved instrumentation for the inspection of exotic materials, and thus prevent costly breakdown of critical components due to undetected defects.

TOPIC 2

ADVANCED PRODUCTION RESEARCH FOR DISCRETE PARTS MANUFACTURING

8. Numerical-Controlled Orbital Forging Processes

Dyna East Corporation, Wynnewood, PA

NSF Grant No. DAR80-09693 Amount: $25,000

The project is an investigation of the feasibility of numerically controlled orbital forging in discrete parts manufacturing. Studies will be made of (1) sensitivities to controlling parameters; (2) flow processes in metals; and (3) the use of a feedback mechanism for control. Operator-controlled orbital forging is known in some European countries but virtually unknown in the United States.

* * * * * * *

9. Adaptive Arc Tracking for Welding

The Merrick Corporation, Nashville, TN

NSF Grant No. DAR80-09596 Amount: $25,000

This project is directed toward automatic electric welding. It fulfills a need for investigation of reliable and cost-effective means of weld path sensing. In this approach, electric signals from the welding arc are used directly. These signals are correlated with the joint geometry and weld path to determine the feasibility of using information from the electric arc signal to implement adaptive control of the welding track.

* * * * * * *

10. Adaptive Welding System

Taylor Systems Engineering, Inc., Fair Oaks, CA

NSF Grant No. DAR80-09700 Amount: $24,849

This project is directed to the use of optical techniques to guide an automatic welder. The objectives of this research project are (1) to perform weld environment sensing using a light sectioning technique to obtain detailed weld seam information; and (2) to demonstrate feasibility of preview control of the welding process. The light sectioning method works by projecting a shadow at an angle to the surface of the weld seam. The resulting shadow pattern contains geometric information which is detected by a solid-state camera interfaced with a computer. The information is used in computer-controlled welding system capable of selectting weld patterns which have been predetermined for the particular seam geometry.

TOPIC 3

INDUSTRIAL PROCESSES

11. Toughened Ceramic Adhesives for Structural Ceramics

Ceramic Finishing Company, State College, PA

NSF Grant No. DAR80-09270 Amount: $24,917

The feasibility of using toughened ceramic adhesives to join structural ceramics, such as hot pressed silicon nitride and alumina, is being investigated. Available toughening techniques include stress induced phase transformations, controlled microfracture, particle toughening by coherent precipitation or elongated particle pullout and ductile second phase networks. Joints prepared using these techniques are evaluated using fracture mechanics methods such as double cantilever beam measurements of fracture toughness. These techniques have been developed and used successfully in research on organic adhesives. The factors influencing the degree of toughening and the feasibility of the combined use of toughened adhesives and compressive surface stresses over the joints are studied. Availability of improved joining techniques for structural ceramics can be expected to aid substantially in promoting the use of structural ceramics by increasing the strength of the structures, by introduction of new options for design, and by cost reduction.

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12. Electrorefining of Aluminum

Castle Technology Corp., Lexington, MA

NSF Grant No. DAR80-09300 Amount: $25,000

Aluminum, a metal vital to the national interest, requires large amounts of energy to produce and will be in short supply in the 1980s. Increased recycle of aluminum will reduce import dependence and save large amounts of energy. Wrought aluminum is gaining in use relative to aluminum castings, but existing technology provides only for recycle of wrought scrap to the cast metal. The objective of this project is to investigate a novel, inexpensive, energy efficient approach to the electrorefining of contaminated wrought aluminum scrap that will result in a product suitable for recycle to wrought alloys. The method uses a low temperature aluminum chloride-sodium chloride electrolyte with a stable organic leveling agent to promote a dense adherent electrodeposit.

* * * * * * *

13. Electrorefining of Sodium Using Solid State Rapid Ion Conductors

Ceramatec, Inc., Salt Lake City, UT

NSF Grant No. DAR80-09646 Amount: $24,494

A research and development program is proposed which investigates the production of sodium metal of extremely high purity by electrorefining commercial grades of sodium and by electrowinning sodium from salts or salt mixtures in electrolytic cells. These electrolytic cells will utilize a solid state, rapid sodium ion conductor such as sodium "-alumina or NASICON as electrolytes. The objectives of the proposed research and development are: (1) the design, fabrication, and operation of cells for electrorefining high purity sodium from lower purity grades. This research will provide information about attainable sodium purity levels, effective ceramic lifetime, cell operating temperatures, and useful current densities which are necessary for evaluting the feasibility of an expanded electrowinning process to be researched in Phase II. (2) the selection of several sodium salts and salt mixtures which could be used in the electrowinning process with the three or four most viable systems (from technical and economic viewpoints) being chosen for in-cell evaluation during Phase II.

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14. By-Product Molybdenum Recovery

Hazen Research, Inc., Tucson, AZ

NSF Grant No. DAR80-10576 Amount: $24,900

In recent years, one-half of all the molybdenum contained in billions of tons of porphyry copper ore milled in the United

States was routinely discharged to tailings areas. The purpose of this Phase I research program is to develop a better understanding of the problems of by-product molybdenum flotation and, ultimately, to develop improved flotation conditions so that the recovery of this strategic metal can be increased. The first part of the project entails a detailed evaluation of selected U.S. copper-molybdenum areas and flotation tailings, using various physical, chemical, and optical methods. Various experimental methods for increasing recoveries are developed and applied, in the laboratory, to several U.S. ores. These studies include: coarse middling flotation from plant tailings, varying alkalinity, pulp dispersion techniques, and selective flocculation of sub-sieve size molybdenite.

* * * * * * *

15. Thin Steel Sheet Made From Melt Extracted Flake

Ribbon Technology Corporation, Canal Winchester, OH

NSF Grant No. DAR80-09583 Amount: $24,422

Phase I of this research is to investigate parametric requirements for flake or particulate material made by melt extraction for use in flake metallurgic applications. The program will investigate the quality of flake particulate material as made in various atmospheres to determine the degree of atmospheric control necessary to provide a high quality product. The second investigation will be into the configuration of the particulate matter ranging from short fibrous type of material from the melt extraction process to a flake type material. The various materials produced will be inspected for surface conditions which may present potential problems in the production of metallurgical components from the particulate. An investigation will also be made into shape of the particulate as it affects bulk density prior to press forming of the material. The final step in the first phase would be the press forming of actual small coupons which can be evaluated from metallic strength properties.

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16. Suspended Solids Removal Using Cross-Flow, In-Depth Filtration

T.S. Associates, Inc., Columbia, MD

NSF Grant No. DAR80-10543 Amount: $25,000

Through-flow, in-depth filtration is a well-known technique for the separation of suspended solids from fluid streams, with diatomaceous-earth and multi-media filters being examples. Another technique which has come into increasing use in recent years is cross-flow filtration, an example of which is ultrafiltration with thin-skinned membranes. What does not appear to have been noted in the literature, however, is that many of the relatively thick filter media used in through-flow filtration may be equally well suited for use in the cross-flow filtration mode. Many of the techniques used in through-flow filtration, such as the addition of filter-aids in either a precoat or an additive mode, may also be quite effective in cross-flow filtration. Demonstration of the feasibility of the concept just noted will result in a technology for suspended solids separation which is efficient, relatively inexpensive, and has low energy requirements. The technology will be of considerable value in municipal and industrial wastewater treatment as well as in many industrial processes. In this project, the feasibility of application of thick filter media in cross-flow filtration of suspended solids is tested through controlled small-scale laboratory experiments on a range of commercially available filter media.

TOPIC 4

DEEP MINERAL RESOURCES

17. A Multi-Channel Ultrasensitive Analyzer for Mineral Resources

General Ionex Corporation, Newburyport, MA

NSF Grant No. DAR80-09568 Amount: $25,000

This research is investigating the feasibility of utilizing an ultra-sensitive mass spectrometer with a cesium beam sputter to determine the concentrations of elements in a geologic sample. Attempts are being made to measure concentrations as low as 10^{-11}. By this technique, rapid simultaneous ultra-sensitive measurements of concentrations of the majority of elements in a very small mineral or rock sample can be accomplished. The energy distribution of a selection of negatively charge ions produced from samples under bombardment are being measured. The data obtained is being utilized to demonstrate the concept and to determine design criteria for a final instrument package.

* * * * * * *

18. Interpolation of N-dimensional Geophysical Data

Zycor, Inc., Austin, TX

NSF Grant No. DAR80-09879 Amount: $22,566

The project is to devise a mathematical technique to interpolate irregularly spaced data in three or more dimensions. The objective of Phase I is to develop the theory needed to accurately interpolate N-dimensional geological or geophysical data to the modes of a regular spaced N-dimensional grid. The resulting algorithms will allow geophysical field data, which have been obtained at irregular sampling intervals or over irregular tracts to be properly interpolated in three dimensions for accurate plotting on a uniform two or more demensional grid. The project will begin by generalizing an existing two dimensional scheme to three and more dimensions in order to determine similarities between two, three and N-dimensional interpolation problems. Several multidimensional interpolation techniques may be developed to suit different kinds of geologic data.

TOPIC 5

ALTERNATIVE BIOLOGICAL SOURCES OF MATERIALS

19. Microalgae Production of Glycerol and Related Chemicals on Saline Waters

Ecoenergetics, Inc., Vacaville, CA

NSF Grant No. PFR80-09848 Amount: $24,901

Glycerol, an important industrial chemical, is synthesized by salt-tolerant algae of the Dunaliella genus. However, the principal problems with an envisioned process are the cost of harvesting the algae, maintaining a stable culture, the high capital costs of the ponds, and the processing of the algae biomass to obtain desired products. The objective of this project is to develop a low-cost harvesting technique for the glycerol-producing algae and to screen other salt-tolerant algae for high concentrations of valuable osmotic regulators (chemicals) including cyclitols and proline.

* * * * * * *

20. Investigation of a New Source of Natural Rubber in the United States

Native Plants, Inc., Salt Lake City, UT

NSF Grant No. PFR80-09401 Amount: $24,999

In addition to guayule, several other plants were studied as potential sources of natural rubber for the U.S. during World War II, e.g., Russian dandelion, Madagascar rubber vine, rabbitbrush and Edisons' goldenrod. The objective of this award is to assess the current potential of rabbitbrush, chrysothamnus nauseosus, a native of the western United States. It is more cold tolerant and grows over a wider region than guayule. This award supports a study which consists of four tasks: collect plants from 9 regions in 10 states; extract the rubber and compare yield and quality with guayule rubber; assess the environmental characteristics at the sample sites; and formulate plans for further research.

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21. The Chinese Tallow Tree as a Source of Petroleum Substitutes

Simco, Inc., Weston, CT

NSF Grant No. PFR80-10567 Amount: $25,000

The Chinese tallow tree, Sapium Sebiferum Roxb., is an introduced species of semi-tropical Euphorb which has become naturalized in the coastal wetlands from South Carolina to Texas. It is a potential high-yielding source of fat and oil which could substitute for petroleum derived lubricants and chemical intermediates. This project is making a preliminary survey of the economic potential of the Chinese tallow tree to formulate detailed research plans for its development and exploitation.

TOPIC 6

MICROBIAL FERTILIZERS, ACTIVATORS, AND CONDITIONERS

22. A Mycorrhizal Inoculated Containerized Plant Growing System

Native Plants, Inc., Salt Lake City, Utah

NSF Grant No. DAR80-09402 Amount: $24,999

Vesicular-arbuscular (VA) fungi are beneficial microorganisms symbiotically associated with roots of most land plants including the major shrub species found in the semi-arid regions of the western United States. VA mycorrhizae can increase both growth and survival of shrubs transplanted into disturbed soils and therefore may play an important role in the disturbed land revegetation. For most severely disturbed soils, such as surface mine spoils, containerized planting systems are the only acceptable method for revegetation. However, even these systems are only marginally successful because VA mycorrhizal fungal populations are destroyed during topsoil removal, storage, and redistribution. In such cases containerized plants inoculated with VA mycorrhizae will be required for reestablishment of the fungal component and the development of stable mycorrhizal plant community. The purpose of this study is to test the feasibility of developing a large-scale containerized VA mycorrhizae-inoculated plant production system. Three important shrub species suitable for reclaiming disturbed sites in semi-arid regions will be chosen for the Phase I study. Each species will be inoculated in the greenhouse with one of two VA mucorrhizal fungi to be tested. Uninoculated containerized plants will be used as controls. VA mycorrhiza-inoculated planting stock developed in Phase I will be used for testing outplanting performance on disturbed sites in Phase II.

TOPIC 7

HUMAN NUTRITION

23. The Measurement of Dielectric Constant as a Method for Quality Assessment of Frying Oils

Northern Instruments Corporation, Lino Lakes, MN

NSF Grant No. PFR80-10551 Amount: $24,550

Thermal oxidation of frying oils results in the production of decomposition products, some of which are known to be toxic. This deterioration increases an oil's polar components thereby increasing its dielectric constant. An instrument to measure the change has been developed and is being tested under a variety of conditions. Changes in dielectric constant are being correlated with changes in oil composition as determined by gas chromatography.

TOPIC 8

ADVANCED MARINE FARMING

24. Enrichment of a Brackish Water Pond for Shellfish

Ocean Pond Corporation, Fishers Island, NY

NSF Grant No. DAR80-09292 Amount: $18,000

A major constraint upon the culture of edible marine organisms on a commercial scale in most coastal states is the lack of availability of suitable culture areas. Many ecologically favorable areas of the coastline are closed to aquaculture as a result of zoning restriction, local ordinances, and social resistance. As a result, the only recourse for many aquaculture enterprises may be to develop highly intensive culture techniques in areas of limited size. Ocean Pond Corporation has initiated experiments in the enrichment of a brackish water pond for the purpose of increasing the yield of American oysters (Crassostrea virginica). Preliminary small-scale experiments have indicated that the standing crop of phytoplankton, the primary source of oyster nutrition in the surface layers of the pond, may be increased by two orders of magnitude when enriched with bottom water. An artificial upwelling system to bring bottom water to the surface will be installed by means of a wind-driven circulator, activated by a windmill. The objective is to determine if a significantly large area of the pond will show increased primary productivity, with significant benefits in terms of oyster growth and annual yields.

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25. Off-Shore Abalone Farm Research Project

Pacific Ocean Farms, Ltd., Carmel Valley, CA

NSF Grant No. DAR80-09772 Amount: $25,000

This study provides design solutions to various engineering and bio-engineering aspects of commercial red abalone culture in California. Habitats for the shellfish are being tested in 100-foot deep sites located 2½ miles offshore, where 30-foot waves are encountered. Habitat durability, safety techniques for abalone removal, cost-effective procedures for predator removal and abalone havesting, and related aspects are being analyzed. The research is a valuable contribution to the marine farming field.

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26. Commercial Potential of Sex Reversal on Hybrid Tilapia

Terry M. and Sari K. Astro, Eleele, Kauai, HI

NSF Grant No. DAR80-09881 Amount: $22,486

This study is using thermally discharged brackish water to culture gold colored hybrids of the hardy finfish, *Tilapia*. This fish is a reliable source of inexpensive food protein around the world, and the hybrids in particular show outstanding growth characteristics. Overpopulation of cultured animals, however, leads to stunted offspring, so techniques are being tried to grow sex-reversed fish by treatment with androgenic hormones. The all-male cultures should show optimal growth when the environmental and hormonal conditions needed are determined. The research is relevant to the marine farming field.

TOPIC 9

GROUNDWATER POLLUTION

27. Waste Pond Treatment with Immobilized Liquid Ion Exchangers

Bend Research, Inc., Bend, OR

NSF Grant No. DAR80-09577 Amount: $25,000

The objective of the research is to determine the feasibility of using microporous polymeric fibers containing liquid ion exchangers as a means of removing toxic metal ions from waste ponds. It is anticipated that the selectivity and high capacity for metal ions of liquid ion exchangers which are immobilized in the fibers can be utilized without the problems of phase separation and organic losses. Existing waste ponds that pose a significant threat to groundwater purity and appear amenable to treatment by immobilized liquid ion exchangers will be identified. Polymeric fibers containing suitable immobilized liquid ion exchangers will be developed and tested on synthetic waste solutions, similar to those in actual ponds, to demonstrate the feasibility of the concept. Based upon the success of these laboratory experiments, two specific waste ponds will be selected for further study and field testing of the techniques as a follow-on to the present project.

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28. In-Situ Gelation to Control Emissions from Abandoned Hazardous Waste Sites

Energy and Environmental Engineering, Inc., Cambridge, MA

NSF Grant No. DAR80-09895 Amount: $24,856

The objective of the research project is to determine the feasibility of in-situ polymerization and ion exchange as a reliable method of containing toxic substances in a dump site and preventing their seepage out of the containment area and into the groundwater. The study will determine the conditions under which various monomers injected into a soil matrix will polymerize to form an effective transport barrier and the effectiveness of in-situ polymerized ion exhange barriers for immobilizing toxic anions and cations extracted from leachates. Several toxic anion and cation species will be selected and made into aqueous solutions to simulate leachates found in chemical dump sites.

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29. Halocarbon Emulsions As Safe & Effective Hydrological Tracers

Energy Resources Co., Inc., La Jolla, CA

NSF Grant No. DAR80-09419 Amount: $20,858

The objective of this research is to determine the feasibility of using perfluorinated hydrocarbons as water tracers. Three areas are being investigated: (1) analytical methodology; (2) retention of tracer by various soils; and (3) emulsification characteristics of the tracer. A minimum of two of the following tracer candidates are being investigated: perfluorodecalin, perfluorodimethylcyclohexane, perfluorotributylamine and perfluorodimethylcyclobutane. The goal is to obtain the optimum combination of tracer, surfactant and analytical method for future field investigation.

TOPIC 10

EARTHQUAKE ENGINEERING, ARCHITECTURE AND URBAN PLANNING

30. Morphology of Tensile and Pneumatic Structural Systems for Seismic Design

ABRI, Inc., Cambridge, MA

NSF Grant No. PFR80-09956 Amount: $25,000

Aside from the effects of great fires, over 90 percent of the loss of life occasioned by earthquakes and considerably more than half the property loss result from the failure of works of construction. Tensile and pneumatic fabric structures, because of their lightness and response flexibility, are particularly suited for seismic resistance. Tensile and pneumatic structures have unique advantages in that all parts of the structure are tied together providing for a balanced morphological response to loading. Recent developments in structural fabrics and inflatable thermal quilt insulation systems have made possible the consideration of such structures as permanent construction. The objective of this study is to identify tensile and pneumatic structural systems which are particularly stable under earthquake loading. The types are considered with respect to their structural performance and potential application in earthquake-prone regions.

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31. Application of the Randomdec Technique to Improve the Earthquake Survivability of Structures on Soil Foundation

Advanced Technology & Research, Inc., Silver Spring, MD

NSF Grant No. PFR80-09731 Amount: $25,000

This research applies a new method, Random Decrement Analysis, to measure the damping of structures on soil foundation and to assess their integrity after a major earthquake. The Random Decrement is used not only to measure the damping of the structure and soil foundation, but also to find the resonant frequencies and mode shapes from which it is possible to develop simplified analytical models that simulate their dynamic response. The analytical model can then be used to assess the hazard potential in the event of exposure to a major earthquake. The method is applied to detect major earthquake damage in a structure by noting changes in the Random Decrement signature before and after exposure to the earthquake. This method may provide a very efficient means of structural evaluation because any type of in-service random loading excitation (i.e., wind or earthquake) can be used to obtain the Random Decrement response signature.

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32. Investigation of the Seismic Resistance of Interior Building Partitions

Agbabian Associates, El Segundo, CA

NSF Grant No. PFR80-09921 Amount: $23,864

The strengthening of existing structures for increased seismic resistance is a major priority for the National Earthquake Hazards Reduction Program. This study investigates the effectiveness and participation of interior shear wall partitions when determining the ultimate resistance capacity of a masonry building to seismic loading. If shear wall partitions contribute significantly to the lateral load resistance of a building, there could be a significant reduction in the cost of strengthening existing structures when increased seismic resistance is required. The research combines analysis and testing to investigate the in-plane shear load resistance of various combinations of construction material commonly utilized for interior partition walls. The ultimate goal of this research is to contribute to the establishment of guidelines and recommendations for utilizing existing interior partitions as shear walls and for strengthening these systems when additional shear wall resistance is required.

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33. Mitigation of Seismic Hazards in Tilt-Up-Wall Structures

Agbabian Associates, El Segundo, CA

NSF Grant No. PFR80-09736 Amount: $23,863

Tilt-up-wall construction is a form of precast construction limited primarily to one- or two-story buildings. Wall panels are cast in a horizontal position at the site and after curing for as little as two days can be tilted up and moved into place in the building. Tilt-up panel construction has grown very rapidly throughout the United States, including seismically active areas. The structural integrity of tilt-up buildings during seismic loading has been observed only to a limited degree. Damage to tilt-up buildings was reported in Alaska in 1964 and in San Fernando in 1971. Practical and reliable analysis methods and construction guidelines are needed to determine the seismic response and failure mechanisms of tilt-up-wall structures. This Phase I research identifies improved methods and construction guidelines for the analysis and construction of tilt-up-wall structures subjected to earthquake motions and develops test procedures for execution in a Phase II program. The ultimate product of the research is a set of guidelines and recommendations for tilt-up design and construction in seismic areas.

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34. Establishing a National Testing Capability for the Simulation of Earthquake Loads on Large-Scale Structures

Higgins, Auld & Associates, Inc., Albuquerque, NM

NSF Grant No. PFR80-09884 Amount: $24,628

This project evaluates the feasibility of establishing a national testing capability for subjecting large-scale structures to simulated earthquake loads. This capability is needed to provide data under realistic field conditions which can be used to validate existing design and analysis methods and/or provide the basis for improving these methods. The project involves four major tasks: (1) verification of the need for large-scale testing and identification of high priority projects; (2) identification of potential test sites and documentation of their characteristics and limitations; (3) evaluation of instrumentation and other field support requirements; and (4) development of management and implementation plans and associated cost estimates.

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35. Earthquake Hazard Mitigation by Friction Cells Damping

Iffland Kavanagh Waterbury, New York, NY

NSF Grant No. PFR80-09780 Amount: $23,750

A major hazard is presented by the earthquake vulnerability of existing buildings. To date most efforts to reduce that vulnerability have taken the form of reinforcement to enhance resistance to seismic forces. This research investigates theoretically the basic concept of the mitigation of seismic inertia forces of existing and new framed buildings, through modification of their dynamic damping characteristics by insertion of appropriate friction cells. A friction cell consists of two overlapping steel plates attached to the different joints of a frame. The steel plates are pressed together to maintain friction, but are free to move with respect to each other. The insertion of such friction cells could significantly increase the earthquake resistance of a framed structure at very low cost. In that case, hundreds of thousands of old structures in seismic zones could be made earthquake resistant in an economical manner and the cost of new structures could be reduced. The research of Phase I focuses on the theoretical behavior of a plane, single bay, rigid frame, articulated at the foundation, subjected to seismic and gravity loads. Inelastic nonlinear stability limit, or collapse load under dynamic earthquake loading as well as gravity loads are studied on a computer with and without the insertion of a friction cell.

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36. Earthquake Damage Evaluation

Ruthroff, Englekirk and Hart, Inc., Los Angeles, CA

NSF Grant No. PFR80-09902 Amount: $24,301

The research develops a computer program which calculates the expected dollar damage sustained by a specific building due to earthquake. The program incorporates the uncertainty in various parts of the estimation process and the damage estimates reflect this uncertainty. The computer program is for use by the structural engineers. It reflects the special requirements imposed by the structural design profession and the developer/structural engineer relationship. The developed computer program is to be made available to all licensed structural engineers.

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37. Methodology for Evaluating and Improving Operational and Non-Structural Aspects of Office Buildings

Space for People, Los Angeles, CA

NSF Grant No. PFR80-09893 Amount: $25,000

The ultimate product of this research is a commercially viable methodology for evaluating and improving operational and non-structural aspects of office buildings to reduce earthquake loss. Office buildings and their occupants and contents constitute a vital national resource. Fifty-one percent of the American work force works in office buildings. Though most office buildings do not qualify as critical facilities, they do deserve major attention in the development of earthquake loss reduction methodologies. A pressing national need exists for a methodology for evaluating and improving operational and non-structural aspects of office buildings. Previously, attention has been directed to structural survival without consideration of non-structural effects. However, there is increasing recognition that operational and non-structural aspects are significant factors in the total amount of the loss that an office building and the organizations and individuals who occupy that building are likely to suffer in an earthquake. This research is based on study of experience of non-structural damage in earthquakes and study of associated occupant behavior. These studies provide the basis for development of a hazard evaluation methodology.

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38. Response Surface Method in Geotechnical/Structural Analysis

Weidlinger Associates, Menlo Park, CA

NSF Grant No. PFR80-09770 Amount: $24,122

Though sophisticated modeling techniques have been developed for the study and design of structures to resist earthquake loads, because of high computer costs they are not widely used in statistical analyses of geotechnical/structural systems. While accurate modeling of system behavior requires details to be considered, the system model must also be fast-running for repetitive computations. The objective of this research is to investigate the feasibility of applying the response surface method to statistical analysis of geotechnical/structural systems. In the response surface method, graduating functions are developed systematically to provide fast-running approximations to a long-running system model. The graduating functions can then be used in statistical evaluations in place of the long-running model. Potential applications include probabilistic analysis of dynamic, nonlinear soil-structure systems and complex structures where finite element methods have previously been limited to deterministic analysis.

TOPIC 11

SCIENCE AND TECHNOLOGY TO AID THE HANDICAPPED

39. Electrodes to Aid the Handicapped

Annex Research, Santa Ana, CA

NSF Grant No. PFR80-09361 Amount: $25,000

A reliable and low cost method to measure potassium (K^+) and calcium (Ca^{2+}) electrolytes during patient hemodialysis is needed. Imbalance of these electrolytes can cause cardiac arrythmias, irreversible complications and death. The thrust of this research is to study the feasibility of solid-substrate technology in the development of disposable K^+ and Ca^{2+} electrodes and simple, portable meters suitable for bedside monitoring during dialysis. The ability to monitor K^+ and Ca^{2+} continuously or frequently with disposable electrodes and simple, portable, dedicated, digital meters results in lowering the cost of hemodialysis treatment while providing better care.

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40. The Effect of Chemical Modification of Bone Cements on Their Young's Moduli

Polysciences, Inc., Warrington, PA

NSF Grant No. PFR80-09941 Amount: $24,965

As prosthetic procedures are used on increasingly younger and more active patients, the functional life of the prosthetic system must be extended. The present cement used in fixation of prostheses *in vivo* has been the principal cause of orthopedic failures. Gross modulus mismatches in mating bone to prosthesis by cement has led not only to prosthesis failure, but bone resorption, tissue necrosis and deterioration and/or movement of the implant devices and other complications, particularly as the implants age. The specific objective of this research is a study of the effect of systematic variations in the composition of a proposed bone cement. To be useful as a cement, the rheological properties of compositions of polymer and monomer have to be suitable and rates of polymerization at room temperature have to be within a certain time frame.

The research approach consists of two stages--a material synthesis stage during which several acrylate and methcrylate polymers are being prepared, and a physical testing state to determine the young's moduli of the "cured" composition of these cements. Improved bone cement will significantly reduce medical care cost, improve surgical techniques, and patients may lead more active and productive lives.

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41. Microprocessor-Based Integration of Artificial Reflexes and Sensory Feedback for Prosthetic Control

Scientifc Systems, Inc., Cambridge, MA

NSF Grant No. PFR80-09412 Amount: $25,000

This project seeks to improve the performance and usefulness of prosthetic limbs for the handicapped. The specific objective of this project is to develop a microprocessor-based prosthetic aid so that the requirements for continuous visual supervision of prosthetic movements are lowered. Research activities are underway on the design and development of necessary hardware and control systems for a prosthetic arm.

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42. Voice Response Aids for the Handicapped

Signal Technology, Inc., Santa Barbara, CA

NSF Grant No. PFR80-09724 Amount: $25,000

The usefulness of voice response devices for the handicapped, especially the blind, is a well-acknowledged fact. As an example, it would be much easier for the blind to operate a computer if the machine could respond to the operator with voice. This study involves a technique for storing speech in a highly efficient manner based on recent advances in the information theoretic coding of speech signals. The technique allows the vocabulary of a voice response device to be expanded by factors of two or better at little additional cost. The development of these coding techniques will allow speech sounds to be stored digitally in a highly efficient manner in a portable device. Without such coding techniques, voice response devices would simply be too bulky and expensive for general use. Although the technique of vector quantization is still in its theoretical state of development, it offers significant advantages (32,000 bps) over conventional digital coding (2,400 bps) techniques.

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43. Enhancement of Speech Intelligibility for the Hearing Impaired

Signatron, Inc., Lexington, MA

NSF Grant No. PFR80-09372 Amount: $25,000

Conventional hearing aids are inadequate for people with sensorineural hearing loss. A truly effective hearing aid would be one that would work in a noisy environment. A substantial improvement in hearing aids is possible by designing signal processing that takes into account the properties of speech generation, perception, and characteristics of sensorineural hearing loss. The product of this research is to enhance speech intelligibility by removing pitch irregularities and by emphasizing perceptually important speech features. By removing pitch irregularities, the effects of noise are further reduced through adaptive filtering of the speech waveform. The use of signal processing in the hearing aid is leading to a significant improvement in the quality of hearing aids.

TOPIC 12

APPROPRIATE TECHNOLOGY

44. Cost Reduction in Irrigation Well Pump Application

Aerospace Research Corporation, Roanoke, VA

NSF Grant No. ISP80-09275 Amount: $24,952

The objective of this research is to determine whether rotational motion of water that can be induced by its passage across vanes ahead of the impeller of a pump can extend the range of flow over which the pump can operate with maximum efficiency. All factors that affect the performance of a standard water pump with a nominal capacity of 600 gallons per minute are being evaluated to determine the optimum placement and angle of the vanes for extending the range of maximum efficiency.

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45. Testing and Evaluation of Equipment Used in Recycling Centers

Cal Recovery Systems, Inc., Richmond, CA

NSF Grant No. ISP80-09629 Amount: $20,772

The objective of this project is to assess the feasibility of conducting resource recovery from municipal solid waste at small recycling centers. The important components of resource recovery systems are being identified and equipment currently available for each step is being evaluated to determine performance characteristics. The efficiency of separation, operational and maintenance characteristics, safety, and environmental considerations are being evaluated for system components. The feasibility of separating metal containers, fabricated from combinations of steel and aluminum, is being investigated for application at small recycling centers.

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46. Correlation Between Early Linear Measurements and Future Performance and Carcass Characteristics in Cattle

Control Dynamics Company, Huntsville, AL

NSF Grant No. ISP80-09615 Amount: $24,813

The objective of this project is to assess the feasibility of using easily obtained, linear measurements of calf-frame characteristics to predict animal performance and quality. Measurements are being made of potentially useful characteristics minimally at birth and at seven and fourteen months of age. Approximately 1,200 animals are being surveyed during the initial phase of this research to identify those measurements most highly correlated with animal performance and quality consistent with ease of measurement.

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47. Small Scale Reclamation/Disposal of Toxic Porcelain Enameling Wastewater Sludges

Donohue & Associates, Inc., Sheboygan, WI

NSF Grant No. ISP80-09922 Amount: $25,000

The aluminum porcelain enameling industry generates, as a by-product, small quantities of inorganic wastewater sludges which contain significant amounts of heavy metals including lead, chromium, cadmium, and selenium. The objective of this project is to determine the feasibility of small scale, on-site methods for use in managing the porcelain enameling process sludges. The methods being studied include potential use of alternate raw materials, recycling of the sludges to minimize the amount produced, removal and separate disposal of objectionable heavy metals, encapsulation and fixation of the heavy metals and conditioning and placing the sludges in on-site segregated landfills.

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48. Small Purification Systems

Electro-Chlor Corporation, Worthington, OH

NSF Grant No. ISP80-09380 Amount: $25,000

The objective of this project is to determine the feasibility of producing solutions of chlorine from table salt and from spent water softener brines for use in disinfection of domestic wastewater. Small electrolytic cells are being evaluated to determine the design requirements for their use in small water and wastewater treatment systems. The production of chlorine from water containing relatively low concentrations of chlorine ions is being investigated for potential application in disinfection of drinking water.

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49. Biodegradable Solid Waste Conversion into Earthworm Castings

Flowerfield Enterprises, Kalamazoo, MI

NSF Grant No. ISP80-09755 Amount: $25,000

Stabilization of the organic matter in household kitchen wastes by use of earthworms has been determined to be technically feasible for small, single and multiple family dwelling units. The practicability of using this concept to provide for small-scale, decentralized conversion of household kitchen wastes into earthworm castings for use as a soil amendment will depend upon its acceptability by potential users. The objective of this project is to determine the role that attitudes of residents, managers, owners, and developers of multi-family residential units have toward use of earthworms to process household kitchen wastes in modular units designed for multiple family dwellings. This information is being used to determine whether it is feasible to design an acceptable system specifically for multi-unit dwellings and to define the living or housing situation optimal for acceptability of this concept of conserving the resource values contained in household kitchen wastes.

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50. Managing a Small Scale Solid Waste Resource Recover Facility

Floyd Browne Associates, Ltd., Marion, OH

NSF Grant No. ISP80-09904 Amount: $24,793

The objective of this project is to determine the feasibility of modifying small landfill operations for management of mixed household refuse to include resource recovery. Evaluated is resource recovery when practiced at the working-face of an operational landfill. The study includes assessment of the quality of extracted materials, site-burial for temporary storage, and seasonal variations in recoverable components of the waste. Ferrous metal separation is being accomplished by an electromagnet and non-ferrous metals are being removed by hand from a conveyer belt. The apparatus being used is portable for movement to alternative locations during the placement operations.

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51. Development of Mineral Wool from Industrial Wastes

Glass & Ceramics International, Inc., Lomita, CA

NSF Grant No. ISP80-09362 Amount: $24,961

The objective of this project is to assess the feasibility of converting mixtures of cement kiln dust and the ash residue from combustion of coal into a mineral product resembling rock wool and also potentially capable of being used for analogous applications. The coal ash being used in this research is being obtained from a Southern California Edison power generating plant and the cement kiln dust is being obtained from the California Portland Cement, Inc., Mohave Plant. The coal ash and cement dust residues are being ground, screened, chemically characterized, mixed in varying proportions, melted and then cooled by placement in aerated water. The products are being analyzed and compared with commercial mineral wool products.

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52. Permanent Cropping System for Small-Scale Farms

International Science and Technology Institute, Inc.,
Washington, DC

NSF Grant No. ISP80-10547 Amount: $25,000

The objective of this project is to study the merits and problems associated with an alternative to conventional agricultural practice and to determine its feasibility. The alternative system is based upon concepts of minimum tillage, intensive cropping, and dependence on organic substances as soil additives to improve and sustain its quality. The relative and combined merits of these concepts are being considered to devise the optimum combination of processes, equipment, and management strategies for potential adoption as a permanent cropping system for small farms.

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53. Elimination of Septic Tank Sludge Transport Via Truck

George D. Ward and Associates, Portand, OR

NSF Grant No. ISP80-09416 Amount: $24,728

The objective of this project is to determine the feasibility of managing liquid residues from septic tanks by disinfection with lime within the tank prior to removal of the residues for incorporation into topsoil by direct injection. The system being studied is projected as being capable of being transported to each site as an alternative to centralized systems for treatment of these residual wastes which would require transport of the residuals to the treatment and management site.

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54. An Inexpensive Biologic Method of Upgrading Lagoon Effluent

Dufresne-Henry, Inc., North Springfield, VT

NSF Grant No. ISP80-09414 Amount: $25,000

The objective of this project is to determine the feasibility of using fresh water mussels (Lampsilis radiata) to improve the efficiency of oxidation ponds used for treatment of domestic wastewater. The study includes determination of maximum organic loading, heavy metal tolerance, and the effects of temperature, dissolved oxygen concentration, and pH on the ability of mussels to perform a treatment function in the ponds used. Mussels are being obtained from their natural habitat in Lake Champlain for laboratory and field evaluation of their potential for reducing costs and for improvement of the effluent quality from oxidation ponds used to provide secondary treatment for wastewater from small communities.

TOPIC 13

APPLIED RESEARCH PROJECT SUPPORT

55. An Anthropometric Data Base for Commercial Design Applications

Anthropology Research Project, Inc., Yellow Springs, OH

NSF Grant No. DAR80-09861 Amount: $23,895

This study is to determine the feasibility of an innovative approach for satisfying commercial needs for anthropometric data. The approach consists of obtaining the necessary information either by extrapolating it from existing, primarily military data or by employing small-scale surveys tailored to specific commercial needs. Phase I is to determine: (1) the extent to which military data can be used to represent civilian body size dimensions; (2) where gaps in the data occur; and (3) whether comparative subgroup analysis can effectively fill these gaps. If this phase is successfully accomplished, the resulting data will be tested in combination with small-scale sampling in Phase II to empirically validate the overall approach. If the usefulness of this approach is demonstrated, then the likelihood of commercial support for the establishment of an anthropometric design center which provides industrial users with valuable information in a usable form at a minimal cost is foreseen.

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56. Supply-Oriented Regional Macroeconometric Forecasting Model

Applied Forecasting and Analysis, Inc., Palo Alto, CA

NSF Grant No. DAR80-09565 Amount: $24,635

A forecasting model of regional economic growth is being constructed which is specified within the framework of a comprehensive set of regional income and product accounts. Phase I work involves identifying appropriate data sources for the construction of the regional accounts, and also demonstrating the feasibility of constructing the model and the income and product accounts for one state and one standard metropolitan statistical area.

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57. Improvement of the Transverse Strength of Graphite/Aluminum Composites by Hybridization with SiC Whiskers

Artech Corporation, Falls Church, VA

NSF Grant No. DAR80-09721 Amount: $24,305

Graphite reinforced aluminum is one of the most promising composite materials being investigated today, but its usefulness until now has been limited by a very low transverse strength due to weak filament-matrix bonding. This project addresses the problem by incorporating silicon carbide whiskers to form a hybrid composite. Preliminary work has shown that silicon carbide whiskers can indeed substantially improve the transverse strength of graphite/aluminum. The research is directed at optimizing material parameters, developing fabrication techniques, and generating an extensive base for mechanical data, in order to win acceptance of the concepts and stimulate application.

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58. Investigation of the Super-Plastic Drawing of Acrylic Fibers

Fiber Materials, Inc., Biddeford, ME

NSF Grant No. DAR80-09869 Amount: $23,900

The objective of this research is to uncover new scientific facts necessary to commercialize small diameter oxidized polyacrylonitrile insulating fibers for use as a substitute for cancer causing asbestos in fire and heat protective clothing. A discovery was made during related research on graphite fibers that super-plastic deformation can occur during the oxidation of polyacrylonitrile (PAN) fibers. Small diameter oxidized PAN fibers can be made on an experimental basis from standard commercial fiber tows using super-plastic drawing techniques. Insufficient information is known at present to scale-up the potential super-plastic drawing process to the levels required. Specific objectives of this project are to determine the role of deformation of the oxygen content of the drawing furnace atomosphere, and the existence of a possible critical temperature range or critical fiber oxygen content. In addition, the possible role of oxidation reaction products as internal lubricants in the fibers during drawing will be studied.

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59. Hydrostatic Extrusion of In-situ Process Superconductive Wire for Use in NMR Magnets

Intermagnetics General Corporation, Guilderland, NY

NSF Grant No. DAR80-09738 Amount: $23,900

Intermagnetics General Corporation is studying hydrostatic extrusion as a method of preparing in-situ multifilamentary. Nb_3Sn-Cu superconducting wire for use in very high frequency, high resolution NMR magnets. At the present time, the in-situ process is limited to superconducting wires smaller than 0.38 mm in diameter because of the necessity to diffuse tin into the composite from the surface of the wire. This study circumvents this fundamental limitation by incorporating filaments of tin in the Cu-Nb billet. Because of the low melting point of the tin such a composite is not fabricable by conventional processing technology. The study is determining the feasibility of producing this material by hydrostatic extrusion whereby the tin is maintained in the solid state until the wire is drawn to final size. The wire is then reacted at high temperature to form the Nb_3Sn. The objective is to offer a technology for producing at low cost a high current density, high field conductor of low cost which will extend high resolution NMR persistent mode magnets beyond the present 500 MHz limit.

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60. Alternative Silver Zeolite Concepts

Ionex Research Corporation, Broomfield, CO

NSF Grant No. DAR80-10586 Amount: $25,000

The primary objective of this project is the synthesis and evaluation of a series of significantly lower cost silver exchanged zeolites which exhibit high adsorption characteristics for the removal of airborne species. Several suitable materials with desired microporosity are converted into different types of zeolite structures. Those zeolites found to possess desirable hardness and suitable particle size are completely silvered and the silvered products are tested for methyliodide absorption efficiency. Performance and test data using radioactive iodine 131 is obtained.

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61. Advanced Underwater Telemetry and Voice Links for Inland and Coastal Waters Research

Osborne-Hoffman, Inc., Point Pleasant Beach, NJ

NSF Grant No. DAR80-09716 Amount: $25,000

A need for reliable underwater communications in shallow waters exists. Applications include water quality monitoring, the study of fish life, the exploration of mineral resources, as well as salvage and rescue operations. Transmission of data in shallow waters is more difficult than in the open seas. In shallow waters, communications are degraded by strong multipath signals, the presence of obstacles, man-made noise, and currents. These degradations sometimes totally obliterate underwater communications. This study is to show the feasibility of using a spread-spectrum transmission format with fast Fourier Transform processing for underwater links. Digitization of voice by Delta modulation and vocoder will be considered. Theoretical analyses and in-situ experiments will be performed to establish bandwidth, symbol rate and bit error constraints. This characterization is presently unavailable for shallow waters. The results will lead to conclusions about telemetry rates and voice transmission ranges. Present telemetry rates, limited to bit rates of tens of Hz, should be improved by at least an order of magnitude. Savings of dollars, manpower, and lives will result.

* * * * * * *

62. Theoretical Modeling of an Innovative Unidirectional Surface Acoustic Wave Transducer

R. F. Monolithics, Inc., Dallas, TX

NSF Grant No. DAR80-09600 Amount: $24,030

An important national resource, the radio frequency spectrum from 30-1000 MHz, is underutilized due to limited selectivity of current radio frequency receivers. However, there is a demand for more radio communications channels in this frequency range which is currently not being satisfied because of potential interference to existing services. A low cost, efficient, highly selective bandpass filter technology is needed to improve spectrum utilization. The objective of this research is to conduct a theoretical modeling analysis of an unidirectional surface acoustic wave transducer in order to assess its feasibility as a selective bandpass filter.

Alphabetical List of Awardees

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State Listing of Awardees

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California	5, 6, 7, 10, 19, 25, 29, 32, 33, 36 37, 38, 39, 42, 45, 51, 56
Colorado	60
Connecticut	21
Hawaii	26
Maine	58
Maryland	1, 16, 31
Massachusetts	12, 17, 28, 30, 41, 43
Michigan	49
Minnesota	23
New Jersey	61
New Mexico	34
New York	2, 3, 4, 24, 35, 59
Ohio	15, 48, 50, 55
Oregon	27, 53
Pennsylvania	8, 11, 40
Tennessee	9
Texas	18, 62
Utah	13, 20, 22
Vermont	54
Virginia	44, 57
Washington, D.C.	52
Wisconsin	47

References Refer to Entry Numbers

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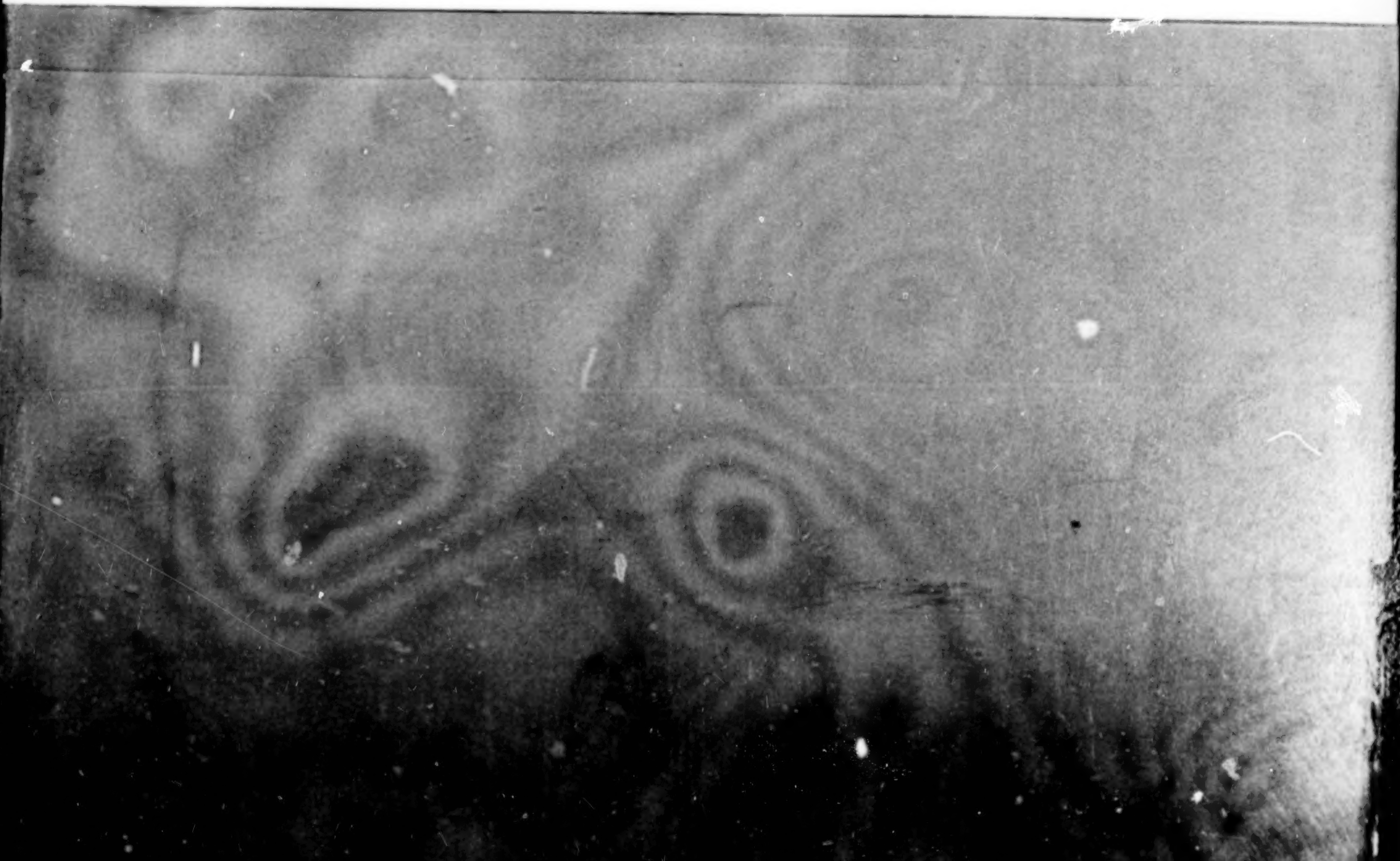

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